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THE GEORGE WASHINGTON UNIVERSITY
Graduate School of Arts and Sciences

TOWARD THE DEVELOPMENT OF
A NAVY-CENSUS OCCUPATIONAL DICTIONARY

by

Irene Kyriakopoulos

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The Census and Navy occupational classification systems are outlined and examined for the purpose of identifying the civilian occupations which correspond to each Navy rating. The procedure for and problems encountered in matching occupations in each of these systems are described. The results of the matching are presented in the form of a Navy-Census cross-reference dictionary, to be used in forthcoming analyses involving Navy and civilian manpower problems.

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0. Introduction

Occupational analysis in the military sector of the economy has
assumed new dimensions of importance as a result of the termination of
the military draft. To facilitate and improve analysis of the military
and civilian labor markets, it is often necessary to compare military
and civilian occupations. As will be indicated below, this is not easy
to do since no occupational cross-references between the two sectors
exist. The major objective of this paper is to create such a cross-
reference linking Navy and civilian occupations.

Presently, there exist several occupational classification systems
for the civilian and military sectors of the economy. Each of these sys-
tems is designed to serve a different purpose and to satisfy a particular
group of users. On the civilian side, the major systems are those de-
veloped by the Bureau of the Census and the Department of Labor. The
latter, known as the Dictionary of Occupational Titles [10], is most
closely related to the system(s) used in the military; however, because
employment and earnings data are lacking for it, it is of limited utility.

Employment and earnings information, on the other hand, are provided for Census occupations. Hence, given the need for employment and earnings data for a wide variety of purposes relating to the competitiveness of military pay in an all-volunteer environment, only the Census classification can be utilized. On the military side, the primary classification is the one developed by the Department of Defense (DOD). Each of the services, however, has its own classification system which ties to the DOD system. As the Navy occupational classification system is different from that of the remaining services, the task of constructing an occupation cross-reference system is doubly difficult. In the pages that follow, a first step is taken to bridge the gap between the Census occupational classification system and the occupational classification system used by the Navy.

In Part 1 of this paper, the nature and structure of the Census occupational classification system is examined. In Part 2, the Navy occupational system is outlined. The procedure for and problems encountered in matching occupations in each of these systems is described in Part 3. In the last section of the paper, the cross-reference dictionary to be used in forthcoming analyses is presented.

1. The Census Occupational Classification System

Presently, the occupational classification system of the Bureau of the Census is the major such system for the civilian sector of the U.S. economy. The development of this system can be traced to its first use in the population Census of 1820. In the early Census, occupations were broken out primarily on the basis of industrial attachment. In later Censuses, principally due to the effects of Alba Edwards, a socio-economic grouping of occupations was developed [4]. The system as currently structured consists of 12 major occupation groups containing 441 detailed occupations. There is also an intermediate level of classification with 129 occupations arranged into the same 12 major groups. At the detailed level, for example, one finds "household appliance and accessory installers and repairmen" in the major occupation group "craftsmen and kindred workers." At the intermediate level, however, this

occupation is grouped together with a number of other mechanics and re-
pairmen occupations under the heading "other mechanics and repairmen"
[6]. Obviously, the choice of level of aggregation depends on the na-
ture of the problem under investigation, the user's particular needs,
and on available data.

Occupational data from the 1970 Census are based on questionnaires
received either from a 15 percent sample of the population and/or a more
select 5 percent sample. The data provide information on (1) type of
work performed (e.g., television repairman, spray painter, farm operator,
junior high school teacher), (2) industry (source of employing organiza-
tion), and (3) ownership or organization (e.g., self-employed, govern-
ment employee, private employee). Since the information is provided by
respondents, the Census has little control over response quality and
accuracy (except, perhaps, by way of improving the questionnaires), since,
for example, there is nothing to prevent "upgrading." "Persons . . .
tend to upgrade themselves in reporting their occupations. An instructor
may call himself a professor and a machinist helper may say he is a
machinist" [5, p. 14]. Job upgrading (or, less frequently, downgrading)
may also be due to the absence of skill criteria in the Census classifi-
cation.

Neglecting the difficulties just noted, the Census generally
classifies workers into occupational categories by grouping together in-
dividual jobs which exhibit similarity in tasks performed. For example,
"only individuals who report their occupation on the Census schedule as
'optologist' or 'optometrist' are classified into the detailed Census
occupational title identified as 'optometrist'" [3, p. 177]. For a
number of occupations, however, criteria other than task similarity are
employed. These criteria include (a) the "social organization of tasks"
(e.g., truck and tractor drivers), (b) relationships of "subordination
or super-ordination" (e.g., managers and foremen), (c) the "structural
demands made of workers" (e.g., personnel and labor relations workers),
and (d) the "institutional setting of jobs" (e.g., attendants and assis-
tants, library; and attendants, physician's and dentist's office) [3,
p. 177].

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The last criterion of occupational classification is particularly illustrative of the possibility of heterogeneous jobs being grouped together in the Census classification system. Although the institutional setting of attendants and assistants in libraries and medical offices are similar, the skills and knowledge required for these jobs can be quite different. However, although archivists and librarians may do similar work, they are classified in different occupations by the Census. Because the Census incorporates a number of different criteria in classifying occupations, it is not always clear that certain detailed occupations belong in the same major occupational category in which they actually appear. For example, "coffee tasters, gamblers, and phrenologists appear along with museum directors under 'professional, technical and kindred workers, n.e.c.'" [4, p. 78]. On the other hand, electronics technicians and electricians possess related skills, yet they are classified in different major occupation groups. Difficulties such as these which reduce the homogeneity of Census occupational categories have been discussed often in the literature [1, 3].

It should be noted also that the Census classification system does not explicitly distinguish skill levels. Skill level is related to age and educational attainment which reflect job experience and training. The fact remains, however, that except in a few instances the Census classification does not distinguish between apprentices, journeymen, and master craftsmen. This point is stressed because the Navy classification system makes explicit the differences in skill level for a given occupation.

2. The Occupational Classification System of the Navy

Navy occupations are called "ratings." The Navy's Enlisted Occupational Classification System consists of three major subsystems: (1) Enlisted Rating Structure, which is the "primary administrative tool for broad classification, identification and reporting of enlisted personnel resources and requirements," (2) Navy Enlisted Classification (NEC) Structure, which consists of specific skills "that provide the framework for enlisted career development," and (3) Special Qualifications,

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which identifies "several highly specialized occupational fields" [11, p. 7]. It is within the Enlisted Rating Structure that advancement takes place, and it is this structure which is used for relating Navy and civilian occupations.

Two principal differences between the Navy and Census systems require mention. The first is that job titles and qualifications are established and administered by the Navy. Requirements for entry, including physical prerequisites, and criteria for advancement in terms of duties to be performed, skills to be mastered, and tests to be passed are detailed for each rating. Thus, Navy occupations are well defined, internally homogeneous, task oriented groupings. A second feature of the enlisted rating structure is that it is skill oriented.

The lower pay grades E-1, E-2, and E-3 correspond to the apprenticeship skill levels. Intermediate skill levels are represented by pay grades E-4 through E-8. The highest pay grade E-9 generally indicates the highest level of skill; individuals in this pay grade are often proficient in a wide range of related skills.[1] The reason this is mentioned is that the individual Navy occupational titles change as a function of skill level; hence, it is necessary to know which ratings represent apprenticeship ratings and which ratings represent the same occupation but a higher skill requirement.

In Table 1, the enlisted rating structure is presented. As can be seen, the Navy distinguishes six major groupings of apprenticeship ratings: airman, constructionman, dentalman, fireman, hospitalman, and seaman. Within the higher skill levels, ratings have been grouped into "families." Families of ratings are formed on the basis of pay grade structure. For example, rating AB (Aviation Boatswain's Mates) is in a family by itself, since it is defined at all pay grade levels. Rating AV (Avionics Technicians) defines a family consisting of ratings AE, AQ,

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[1]The rank designation corresponding to each pay grade is as follows: E-1, E-2, E-3, Striker; E-4, Petty Officer 3; E-5, Petty Officer 2; E-6, Petty Officer 1; E-7, Chief Petty Officer; E-8, Senior Petty Officer; E-9, Master Chief Petty Officer [11].

AT, and AX. These four ratings are defined for pay grades E-4 through E-8, while at the E-9 level all of the ratings merge into rating AV. At level E-9, personnel are broadly qualified and assume wider supervisory responsibility than at lower pay grades. Altogether there are 52 families of ratings; of these, 41 families consist of a single rating, while 11 are multi-rating families by virtue of the high degree of skill substitutability at the E-9 level. On the basis of skill substitutability, families of ratings may be considered as relatively homogeneous, in the sense that substitutability of personnel is explicit within each family at the E-9 and sometimes at the E-8 levels, from the viewpoint of both the employer (Navy) as well as the employee (enlisted man), and is implicit at lower pay grades. Despite the cumbersomeness of the rating structure, the provision of information about "factor substitution possibilities" is a desirable feature for an occupational classification system [1, pp. 200-202] such as the Navy's.

The families of ratings are considered as an intermediate level of aggregation. An even more aggregated classification can be obtained by grouping families of ratings by major apprenticeship group. It is highly advantageous, however, to relate the families of ratings to major DOD occupational groups (see [9]) in order to distinguish groupings of ratings which more closely correspond to the Census occupational structure.[2] This permits clerical and service workers to be separately enumerated, as is indicated in Table 1. Classifying Navy personnel in this manner imposes a problem since the major apprenticeship groupings do not coincide with the major DOD occupation groupings. The problem is unique to the Navy as the other services use the same occupational classification for all pay grades, i.e., in the other services, occupational titles do not depend on pay grade as is the case for the Navy. This problem can be resolved by distributing personnel in the apprenticeship ratings to each of the associated detailed ratings in the same proportion as personnel in grades E-4 and above are distributed. It should

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[2]Navy groups are divided into 12 "deck groups" but this classification cannot be as easily matched with the major Census occupations.

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TABLE 1

Major Enlisted Rating Structure

Major Apprenticeship Groups 1/	DOD Occupation Group 2/	Rating Families	Pay Grades					
			E-4	E-5	E-6	E-7	E-8	E-9
AR, AA, AN (Airmen)	6	AB (Aviation Boatswain's Mates)	AB	AB	AB	AB	AB	AB
	2	AC (Air Controlmen)	AC	AC	AC	AC	AC	AC
	6	AF (Aircraft Maintenancemen)						AF
	6	AD (Aviation Machinists' Mates)	AD	AD	AD	AD	AD	AF
	6	AM (Aviation Structural Mechanics)	AM	AM	AM	AM	AM	AF
	4	AG (Aerographer's Mates)	AG	AG	AG	AG	AG	AG
	5	AK (Aviation Storekeepers)	AK	AK	AK	AK	AK	AK
	6	AO (Aviation Ordnancemen)	AO	AO	AO	AO	AO	AO
	6	AS (Aviation Support Equipment Technicians)	AS	AS	AS	AS	AS	AS
	6	AV (Avionics Technicians)						AV
	6	AE (Aviation Electrician's Mates)	AE	AE	AE	AE	AE	AV
	1	AQ (Aviation Fire Control Technicians)	AQ	AQ	AQ	AQ	AQ	AV

TABLE 1 (Continued)

AR, AA, AN (Airmen)									
1	AT	(Aviation Electronics Technicians)	AT	AT	AT	AT	AT	AT	AV
1	AX	(Aviation Antisubmarine Warfare Technicians)	AX	AX	AX	AX	AX	AX	AV
2	AW	(Aviation Antisubmarine Warfare Operators)		AW	AW	AW	AW	AW	AW
	AW	(Aviation Antisubmarine Warfare Operators)							
5	AZ	(Aviation Maintenance Administrationmen)	AZ	AZ	AZ	AZ	AZ	AZ	AZ
	AZ	(Aviation Maintenance Administrationmen)							
4	PH	(Photographer's Mates)	PH	PH	PH	PH	PH	PH	
	PH	(Photographer's Mates)							
6	PR	(Air Crew Survival Equipmentmen)	PR	PR	PR	PR	PR	PR	PR
	PR	(Air Crew Survival Equipmentmen)							
2	TD	(Tradevman)	TD	TD	TD	TD	TD	TD	TD
	TD	(Tradevman)							
CR, CA, CN (Construction Men)									
7	CU	(Construction Men)	BU	BU	BU	BU	BU		CU
7	BU	(Builders)	BU	BU	BU	BU	BU	BU	CU
4	EA	(Engineering Aides)	EA	EA	EA	EA	EA	EA	CU
7	SW	(Steelworkers)	SW	SW	SW	SW	SW	SW	CU
7	EQ	(Equipmentmen)						EQ	EQ
6	CM	(Construction Mechanics)	CM	CM	CM	CM	CM	CM	EQ
7	EO	(Equipment Operators)	EO	EO	EO	EO	EO	EO	EQ

TABLE 1 (Continued)

Group	No.	Rate	Rating	1	2	3	4	5	6	7
CR, CA, CN (Construction Men)	7	UT	(Utilities Men)	UT	UT	UT	UT	UT	UT	UT
	7	CE	(Construction Electricians)	CE	CE	CE	CE	CE	CE	CE
	7	UT	(Utilities Men)	UT	UT	UT	UT	UT	UT	UT
DR, DA, DN (Dentalmen)	3	DT	(Dental Technicians)	DT	DT	DT				
		DT	(Dental Technicians)	DT	DT	DT				
FR, FA, FN (Firemen)	6	BT	(Boiler Technicians)	BT	BT	BT	BT	BT	BT	
	6	BR	(Boilermakers)	BR	BR	BR	BR	BR	BR	
	6	BT	(Boiler Technicians)	BT	BT	BT	BT	BT	BT	
	6	EM	(Electrician's Mates)	EM	EM	EM	EM	EM	EM	
	6	EM	(Electrician's Mates)	EM	EM	EM	EM	EM	EM	
	6	IC	(Interior Communications Electricians)	IC	IC	IC	IC	IC	EM	
	6	EN	(Enginemen)	EN	EN	EN	EN	EN	EN	
		EN	(Enginemen)	EN	EN	EN	EN	EN	EN	
	7	HT	(Hull Maintenance Technicians)	HT	HT	HT	HT	HT	HT	HT
	7	HT	(Hull Maintenance Technicians)	HT	HT	HT	HT	HT	HT	HT
	7	ML	(Molders)	ML	ML	ML	ML	ML	ML	ML
	7	ML	(Molders)	ML	ML	ML	ML	PM	ML	ML
		PM	(Patternmakers)	PM	PM	PM	PM	PM		
	6	MM	(Machinist's Mates)	MM	MM	MM	MM	MM	MM	
	6	MM	(Machinist's Mates)	MM	MM	MM	MM	MM	MM	
	7	MR	(Machinery Repairmen)	MR	MR	MR	MR	MR	MR	MR

TABLE 1 (Continued)

3	HR, HA, HN (Hospitalmen)	HM	(Hospital Corpsmen)	HM	HM	HM	HM	HM	HM	HM
		HM	(Hospital Corpsmen)						
0	SR, SA, SN 3/ (Seamen)	BM	(Boatswain's Mates)	BM	BM	BM	BM	BM	BM	BM
		BM	(Boatswain's Mates)						
8		CS	(Commissarymen)	CS	CS	CS	CS	CS	CS	CS
		CS	(Commissarymen)						
2		CT	(Communications Technicians)	CT	CT	CT	CT	CT	CT	CT
		CT	(Communications Technicians)						
5		DK	(Disbursing Clerk)	DK	DK	DK	DK	DK	DK	DK
		DK	(Disbursing Clerk)						
4		DM	(Illustrator Draftsmen)	DM	DM	DM	DM	DM	DM	DM
		DM	(Illustrator Draftsmen)						
5		DP	(Data Processing Technicians)	DP	DP	DP	DP	DP	DP	DP
		DP	(Data Processing Technicians)						
1		DS	(Data Systems Technicians)	DS	DS	DS	DS	DS	DS	DS
		DS	(Data Systems Technicians)						
1		ET	(Electronics Technicians)	ET	ET	ET	ET	ET	ET	ET
		ET	(Electronics Technicians)						
2		EW	(Electronics Warfare Technicians)	EW	EW	EW	EW	EW	EW	EW
		EW	(Electronics Warfare Technicians)						

TABLE 1 (Continued)

	SR, SA, SN 3/ (Seamen)							
1	FT	(Fire Control Technicians)	FT	FT	FT	FT	FT	FT
1	FT	(Fire Control Technicians)	MT	MT	MT	MT	FT	FT
1	MT	(Missile Technicians)						
6	GM	(Gunner's Mates)	GM	GM	GM	GM	GM	GM
6	GM	(Gunner's Mates)						
5	JO	(Journalists)	JO	JO	JO		JO	JO
5	JO	(Journalists)						
7	LI	(Lithographers)	LI	LI	LI	LI	LI	LI
7	LI	(Lithographers)						
6	MN	(Minemen)	MN	MN	MN	MN	MN	MN
6	MN	(Minemen)						
4	MU	(Musicians)	MU	MU	MU	MU	MU	MU
4	MU	(Musicians)						
2	OT	(Ocean Systems Technicians)	OT	OT	OT	OT	OT	OT
2	OT	(Ocean Systems Technicians)						
5	PC	(Postal Clerk)	PC	PC	PC	PC	PC	PC
5	PC	(Postal Clerk)						
6	PI	(Precision Instrumentmen)	IM	IM	IM	IM	IM	PI
6	IM	(Instrumentmen)	OM	OM	OM	OM	IM	PI
6	OM	(Opitcalmen)					OM	
5	PN	(Personnelmen)	PN	PN	PN	PN	PN	PN
5	PN	(Personnelmen)						

TABLE 1 (Continued)

SR, SA, SN 3/
(Seamen)

0	QM (Quartermasters)	QM	QM	QM	QM	QM	QM
	QM (Quartermasters)						
2	RD (Radarmen)	RD	RD	RD	RD	RD	RD
	RD (Radarmen)						
2	RM (Radiomen)	RM	RM	RM	RM	RM	RM
	RM (Radiomen)						
8	SD (Steward)	SD	SD	SD	SD	SD	SD
	SD (Steward)						
8	SH (Ship's Servicemen)	SH	SH	SH	SH	SH	SH
	SH (Ship's Servicemen)						
5	SK (Storekeeper)	SK	SK	SK	SK	SK	SK
	SK (Storekeeper)						
0	SM (Signalmen)	SM	SM	SM	SM	SM	SM
	SM (Signalmen)						
0	ST (Sonar Technicians)	ST	ST	ST	ST	ST	ST
	ST (Sonar Technicians)						
1	TM (Torpedoman's Mates)	TM	TM	TM	TM	TM	TM
	TM (Torpedoman's Mates)						
5	YN (Yeomen)	YN	YN	YN	YN	YN	YN
	YN (Yeomen)						

(See page 13 for footnotes)

TABLE 1 (Continued)

1/ R in the second digit indicates pay grade E-1; A in the second digit indicates
pay grade E-2; N in the second digit indicates pay grade E-3.

2/ DOD Occupation Groups:

0   Infantry, Gun Crew, and Seamanship Specialist
1   Electronic Equipment Repairmen
2   Communications and Intelligence Specialists
3   Medical and Dental Technicians
4   Other Technical and Allied Specialists
5   Administrative Specialists and Clerks
6   Electrical/Mechanical Equipment Repairmen
7   Craftsmen
8   Service and Supply Handlers.

3/ Includes stewardsmen apprenticeships: TR, TA, and TN.

be noted that the need to distribute the personnel in the apprenticeship ratings is independent of the objective of relating Navy ratings to DOD occupational groupings. Because of the way in which the Navy rating system is structured, the requirement of distributing personnel in the apprenticeship ratings to the non-apprenticeship ratings arises whenever it is desired to compare Navy occupations with comparable civilian occupations.

Two additional comments pertaining to the Navy occupational classification system warrant mention. As indicated previously, the Navy system is task oriented. Indeed, the definition of tasks is so specific that they are often delineated by area of application. For this reason, the Navy system is closer in concept to the Department of Labor's Dictionary of Occupational Titles than to the Census system. For most analytical studies, however, the latter is more useful than the former. As the area of application is a principal basis for defining occupations in the Navy, similar skills are distinguished depending on whether they apply to aircraft or surface ships, e.g., aviation and seamen storekeepers are classified as two different occupations. This contrasts with the approach used by the Census under which these occupations would most likely be classified as a single occupation. No attempt is made to explicitly modify the Navy occupational system to combine "air" and "sea" occupations, although this should be done if a more refined classification system were to be used. Another difference between the two classification systems, which is shared by the other services, is related to skill delineation. In the Census system, foremen who perform supervisory duties are classified as craftsmen but their particular occupational skill is not enumerated. In the Navy, various levels of supervisory responsibility are implicit in the pay grade structure; supervisory responsibility is delegated in varying degrees among the various ranks, particularly the Chief Petty Officer rank. But, in contrast to the Census classification system, the tasks performed by supervisory personnel are not suppressed in the Navy system. Since only a small proportion of workers fall into the "foreman" class in both the military and civilian sectors, no attempt is made to reconcile this difference in occupational classification.

3. <u>Census versus Navy Occupational Classification Systems</u>

Before an attempt is made to actually match specific Navy occupations, i.e., ratings, to detailed Census occupations, it is essential to emphasize again that the two classification systems have been developed to serve different purposes. The Census system is designed to serve as a public information document to individuals in their capacity as actual or potential employers and employees, but primarily it is a data source for public officials and social scientists. The Census objective is to portray as accurate a picture of the labor market as possible, given the constraints imposed by, and inadequacies and shortcomings of, the reporting system used. On the other hand, the Navy occupational system is an administrative tool designed to promote effective management of a large organization, particularly in the area of central programming and balancing of manpower resources and requirements.

As a result of this difference in purpose, the process of utilizing job descriptions to relate Navy and civilian occupations produces results that often appeal to intuition rather than to strictly deductive reasoning. Ultimately, judgment is involved. What was sought was a reasonable rather than exact correspondence between the two systems of occupational classification. In most cases the correspondence was not too difficult to establish since the tasks performed were reasonably similar. For example, consider the Navy rating Opticalmen (OM) which is described as comprising persons who "maintain, overhaul and repair binoculars, sextants, drafting machines and optical lens grinders" [8, p. 83]. The Census occupation which corresponded to this job description was "opticians, lens grinders, and polishers." Builders (BU) provide an example of a rating involving the performance of many tasks, but all of them fall under the category of construction occupations. The detailed Census occupations corresponding to this rating are: cabinetmakers, cement and concrete finishers; plasterers; painters, construction and maintenance; and the associated apprenticeship occupations when available.

Information on training time for each rating (in [8]) is also helpful in cases where differentiation between similar ratings seems to

be needed. For example, Aviation Fire Control Technicians (AQ) receive
48 weeks of training, whereas Aviation Antisubmarine Warfare Technicians
(AX) receive 22 weeks of training. Though their tasks are similar, the
training time criterion suggests that the AQ rating corresponds to the
Census occupation "electrical and electronic engineering technicians,"
while the rating AX should be assigned the occupation "electricians."
The former are classified in the professional and kindred workers cate-
gory whereas the latter are in the craftsmen and kindred workers category.
Although the two occupational skills are substitutable, for consistency
with the Census approach, personnel in the AQ rating are assigned to the
higher socio-economic occupation.

Still another difference, which is not apparent, but which be-
comes more evident as an attempt is made to reconcile the two classifi-
cations, is that in a number of cases personnel in a given rating receive
training which covers several civilian occupations. Such broad training
is purposeful as military personnel, particularly in the Navy where only
a small number of individuals inhabit and operate complex systems, must
fulfill a number of different functions. For example, Hull Maintenance
Technicians (HT) are "[persons] who repair shipboard structures and
piping systems. They instruct and train personnel in fire-fighting and
damage control procedures" [8, p. 79]. In terms of the Census classifi-
cation, the tasks of HT's correspond to those of shipfitters; plumbers
and pipefitters; and firemen.

Table 2 illustrates the procedure followed in matching Navy occu-
pations to Census occupations. For every rating, the Department of De-
fense (in [8]) describes associated tasks. Additionally, a listing of
"highly related" and "substantially related" civilian jobs is provided.
A thorough study of the rating tasks and the civilian jobs in which such
tasks are performed was the basis for the selection of the comparable
civilian occupations shown in the last column. The results of this
selection procedure are shown for the three ratings discussed above,
i.e., OM, AQ, and HT.

TABLE 2

Illustration of Navy-Census Occupational Matching

Navy Rating and Description	Highly Related Occupation(s)	Substantially Related Occupation(s)	Census Detailed Occupation(s) a/
OM, Opticalmen maintain, overhaul and repair binoculars, sextants, machines and optical gunsights	Lens grinder Jewelry stonecutter Optical glass silverer Inspector, Optical instructor Instrument maker [Foreman, Optical instrument]	Tool inspector Tool maker	Opticians, lens grinders and polishers
AQ, Aviation Fire Control Technicians test, maintain and repair aviation fire control equipment, including bomb directors, computers, gyro-radar and air-launched guided missiles	Electronics technician Airplane electrician	Instrument technician Appliance repairman electrician	Electrical and electronic engineering technicians
HT, Hull Maintenance Technicians repair shipboard structures and piping systems. They instruct and train personnel in fire-fighting and damage control procedures	Plumber Shipfitter Welder Building Superintendent General maintenanceman Fire fighter	Utilityman Metal structure repairman Blacksmith	Plumbers and pipe-fitters; ship-fitters; and firemen, fire protection

a/ Compiled by the author.

Source: U.S. Department of Defense, Office of the Assistant Secretary of Defense, Military-Civilian Job Comparability Manual, 1972, pp. 63-91.

The results of the complete matching are presented in Table 3 and are denoted as the Navy-Census cross-reference dictionary. Of the 71 ratings contained in this table,[3] 45 or 64 percent are associated with a single Census detailed occupation; the remainder are associated with two or more occupations.

In order to assess the extent of commonality between the Navy and Census classification systems, the Navy ratings are grouped by major DOD occupation and compared with "similar" major Census occupations in Table 4. This table is read as follows: the number 5 (row 1, column 2) indicates that five out of a total of eight occupation ratings in the major DOD group "electronic equipment repairmen" are professional occupations in terms of the Census system. The remaining 3 (row 5, column 2) are craftsmen occupations. In other words, the distribution of ratings in a given major DOD group, over all major Census occupations, is read vertically. Read horizontally, the matrix of Table 4 shows the distribution of occupations, in a given Census group, over all major DOD groups; for example, 5 (row 1, column 2) + 7 (row 1, column 3) + ... + [=19] indicates that professional workers are distributed over a large number of DOD groupings. What the first row shows is that there is not one unique major DOD group which contains professional workers; rather, DOD groups (1) through (6) all contain ratings requiring professional worker skills. The greatest degree of homogeneity is found in DOD groups (2), (4), (5), and (6). Thus, all of the "other technical and allied specialists" ratings require professional worker skills; 90 percent of the administrative specialists and clerk ratings are associated with clerical occupations; and 60 percent of the craftsmen ratings are craftsmen occupations. Less homogeneous is the electronic equipment repairmen rating with five professional and three craftsmen occupations. DOD groups 0 and 8 are also heterogeneous; lack of homogeneity among these groups suggests that realignment of the DOD occupational system with the civilian occupational structure should be investigated.

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[3] Ratings AF, AV, CU, EQ, and PI are excluded. See footnote (a) to Table 3.

TABLE 3

A Navy-Census Occupational Cross-Reference Dictionary a/

Navy Ratings	Major DOD-Group b/	Census Detailed Occupation	Major Census Occupational Category
AB Aviation Boatswain's Mates	(6)	Cranemen, derrickmen and hoistmen	(4)
		Garage workers and gas station attendants	(5)
AC Air Controlmen	(2)	Air traffic controllers	(0)
AD Aviation Machinist's Mates	(6)	Aircraft mechanics and repairmen	(4)
AE Aviation Electrician's Mates	(6)	Electricians	(4)
AG Aerographers Mates	(4)	Computer programmers	(0)
AK Aviation Storekeepers	(5)	Stock clerks and storekeepers	(3)
AM Aviation Structural Mechanics	(6)	Air conditioning, heating and refrigeration mechanics and repairmen	(4)
		Welders and flame cutters	(5)
AO Aviation Ordnancemen	(6)	Household appliance and accessory installers and repairmen	(4)
AQ Aviation Fire Control Technicians	(1)	Electrical and electronic engineering technicians	(0)
AS Aviation Support Equipment Technicians	(6)	Automobile mechanics and repairmen	(4)
		Electricians	(4)

TABLE 3 (Continued)

Navy Ratings	Major DOD Group b/	Census Detailed Occupation	Major Census Occupational Category
AT Aviation Electronics	(1)	Electrical and electronic engineering technicians	(0)
AW Aviation Antisubmarine Warfare Operators	(2)	Radio and television mechanics and repairmen	(4)
		Radio operators	(0)
AX Aviation Antisubmarine Warfare Technicians	(6)	Electricians	(4)
AZ Aviation Maintenance Administrationmen	(5)	Shipping and receiving clerks	(3)
BM Boatswain's Mates	(0)	Guards and watchmen	(10)
		Freight and material handlers	(7)
		Longshoremen and stevedores	(7)
BR Boilermakers	(6)	Boilermakers	(4)
		Welders and flame cutters	(5)
BT Boilermen	(6)	Stationary engineers	(4)
		Stationary firemen	(5)
		Welders and flame cutters	(5)
BU Builders	(7)	Cabinetmakers	(4)
		Cement and concrete finishers	(4)
		Plasterers	(4)
		Painters, construction and maintenance	(4)

TABLE 3 (Continued)

Navy Ratings	Major DOD— Group b/	Census Detailed Occupation	Major Census Occupational Category
CE Construction Electricians	(7)	Electricians	(4)
CM Construction Mechanics	(6)	Automobile mechanics and repairmen	(4)
		Heavy Equipment, incl. diesel, mechanics and repairmen	(4)
CS Commissarymen	(8)	Bakers	(4)
		Cooks, except private household	(10)
CYN Communication's Yeoman	(6)	File clerks	(3)
DC Damage Controlmen	(7)	Firemen, fire protection	(10)
		Carpenters	(4)
DK Disbursing Clerks	(5)	Payroll and timekeeping clerks	(3)
DM Illustrator Draftsmen	(4)	Draftsmen	(0)
DP Data Processing Technicians	(5)	Computer and peripheral equipment operators	(3)
DS Data Systems Technicians	(1)	Electrical and electronic engineering technicians	(0)
DT Dental Technicians	(3)	Dental laboratory technicians	(4)
EA Engineering Aides	(4)	Chainmen, rodmen, axmen; surveying	(5)
EM Electrician's Mates	(6)	Electricians	(4)

TABLE 3 (Continued)

Navy Ratings	Major DOD-Group b/	Census Detailed Occupation	Major Census Occupational Category
EN Enginemen	(6)	Air conditioning, heating and refrigeration mechanics and repairmen	(4)
		Heavy equipment, including diesel, mechanics and repairmen	(4)
EO Equipment Operators	(7)	Bulldozer operators	(4)
		Cranemen, derrickmen and hoistmen	(4)
ET Electronics Technicians	(1)	Electrical and electronic engineering technicians	(0)
EW Electronics Warfare Technicians	(2)	Electrical and electronic engineering technicians	(0)
FT Fire Control Technicians	(1)	Electricians	(4)
GM Gunner's Mates	(6)	Blacksmiths	(4)
		Heavy equipment, including diesel, mechanics and repairmen	(4)
HM Hospital Corpsmen	(3)	Registered nurses, dieticians and therapists	(0)
		Health technologists and technicians	(0)
HT Hull Maintenance Technicians c/	(7)	Plumbers and pipefitters	(4)
		Shipfitters	(4)
		Firemen, fire protection	(10)
IC Interior Communications Electricians	(6)	Electricians	(4)

TABLE 3 (Continued)

Navy Ratings	Major DOD—Group b/	Census Detailed Occupation	Major Census Occupational Category
IM Instrumentmen	(6)	Jewelers and watchmakers	(4)
		Office machine mechanics and repairmen	(4)
JO Journalists	(5)	Editors and reporters	(0)
LI Lithographers	(7)	Printing craftsmen	(4)
ML Molders	(7)	Heat treaters, annealers, and temperers	(4)
		Molders, metal	(4)
		Furnacemen, smeltermen and pourers	(5)
MM Machinist's Mates	(6)	Air conditioning, heating and refrigeration mechanics and repairmen	(4)
MN Minemen	(6)	Electricians	(4)
MR Machinery Repairmen	(7)	Lathe and milling machine operatives	(5)
		Machinists	(4)
MT Missile Technicians	(1)	Electrical and electronic engineering technicians	(0)
MU Musicians	(4)	Musicians and composers	(0)
OT Ocean Systems Technicians	(2)	Radio and television mechanics and repairmen	(4)
		Electricians	(4)

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TABLE 3 (Continued)

Navy Ratings		Major DOD Group b/	Census Detailed Occupation	Major Census Occupational Category
OM	Opticalmen	(6)	Opticians, and lens grinders and polishers	(4)
PC	Postal Clerks	(5)	Postal clerks	(3)
PH	Photographer's Mates	(4)	Photographers	(0)
PM	Patternmakers	(7)	Pattern and modelmakers, except paper	(4)
PN	Personnelmen	(5)	Ennumerators and interviewers	(3)
			File clerks	(3)
PR	Air Crew Survival Equipmentmen	(6)	Stockhandlers	(7)
PT	Photographic Intelligencemen	(2)	Photographers	(0)
QM	Quartermasters	(0)	Boatmen and canalmen	(6)
RD	Radarmen	(2)	Radio operators	(0)
			Air traffic controllers	(0)
RM	Radiomen	(2)	Radio operators	(0)
SD	Stewards	(8)	Bakers	(4)
			Cleaning service workers	(10)
			Cooks, except private household	(10)
SF	Shipfitters	(7)	Shipfitters	(4)

TABLE 3 (Continued)

Navy Ratings		Major DOD-Group b/	Census Detailed Occupation	Major Census Occupational Category
SH	Ship's Servicemen	(8)	Tailors	(4)
			Barbers	(10)
			Laundry and dry cleaning operatives	(5)
SK	Storekeepers	(5)	Stock clerks and storekeepers	(3)
SM	Signalmen	(0)	Guards and watchmen	(10)
ST	Sonar Technicians	(1)	Electricians	(4)
SW	Steel Workers	(7)	Shipfitters	(4)
			Sheetmetal workers and tinsmiths	(4)
TM	Torpedomen's Mates	(1)	Heavy equipment mechanics and repairmen	(4)
TD	Tradevmen	(2)	Motion picture projectionists	(4)
			Airplane pilots	(0)
UT	Utilities Men	(7)	Stationary engineers	(4)
			Plumbers and pipefitters	(4)
YN	Yeomen	(5)	Legal secretaries	(3)

(See page 26 for footnotes)

TABLE 3 (Continued)

a/ The ratings AF, AV, CU, EQ, PI which are defined only for pay grades E-9 (and sometimes E-8 and E-9) are excluded, since they denote supervisory functions; they are represented by other ratings in the table which are defined for lower pay grades (see Table 1).

b/ Major Census Occupational Categories:

(0) Professional, Technical and Kindred Workers
(1) Managers and Administrators, except Farm
(2) Sales Workers
(3) Clerical and Kindred Workers
(4) Craftsmen and Kindred Workers
(5) Operatives, except Transport
(6) Transport Equipment Operatives
(7) Laborers, except Farm
(8) Farmers and Farm Managers
(9) Farm Laborers and Foremen
(10) Service Workers
(11) Private Household Workers

c/ Major DOD Groups:

(0) Infantry, Gun Crew, and Seamanship Specialists
(1) Electronic Equipment Repairmen
(2) Communications and Intelligence Specialists
(3) Medical and Dental Specialists
(4) Other Technical and Allied Specialists
(5) Administrative Specialists and Clerks
(6) Electrical/Mechanical Equipment Repairmen
(7) Craftsmen
(8) Service and Supply handlers

d/ In 1973, the ratings SF (Shipfitters) and DC (Damage Controlmen) were consolidated into the single rating HT (Hull Maintenance Technicians.)

Sources: U.S. Department of Defense, Office of the Assistant Secretary of Defense, Military-Civilian Job Comparability Manual, 1972 and U.S. Bureau of the Census: 1970 Subject Reports, Final Report PC(2)-7A, Occupational Characteristics, Washington, D.C.: Government Printing Office, 1973.

TABLE 4

A Census – Navy Occupation Matrix

MAJOR CENSUS OCCUPATIONAL CATEGORIES	MAJOR DOD OCCUPATION GROUP a/								
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Professional, Technical and Kindred Workers		5	7	1	4	1	1		
Managers and Administrators, except Farm									
Sales Workers									
Clerical and Kindred Workers						8	1		
Craftsmen and Kindred Workers		3	2	1			18	11	3
Operatives, except Transport	1						4	4	1
Transport Equipment Operatives	1								
Laborers, except Farm	1						1		
Farmers and Farm Managers									
Farm Laborers and Foremen									
Service Workers	2							2	2
Private Household Workers									

a/ See Table 1 for titles of major DOD occupation groups.

The 71 ratings match to 88 detailed Census occupations. Not all of these occupations, however, are unique, i.e., a given civilian occupation may match with two or more ratings. Neglecting double counting, 42 (48 percent) of the 88 entries in Table 4 are craftsmen occupations and 20 (23 percent) are professional occupations. It is thus of interest to note that 71 percent of the matched civilian occupations contain "top" white and blue collar positions. Noticeably absent are the managerial, sales, farming, and private household occupations. With the exception of the sales occupations, the absence of the other occupations is not surprising. The managerial positions are excluded because this function is performed by officers and they are classified in an entirely different manner.

Another way of summarizing the relationship between the Navy and civilian occupational structures is to compare the number of civilian occupations which are military-related to the total number of civilian occupations. This is done in Table 5 where double counting of the matched civilian occupation entries in Table 4 has been eliminated. Table 5 reemphasizes the orientation of Navy jobs toward the craftsmen occupations. Moreover, although a relatively large proportion of Navy jobs require professional skills, the skills that are required comprise a narrow range of the professional skills utilized in the civilian sector. Finally, the number of civilian occupations which match Navy ratings (67) is small compared to the total number of civilian occupations (441). Thus, the direct crossover between the military and civilian sector appears to be small and restricted primarily to the craftsmen occupations. This concentration can have important implications for the Navy (see [2]).

Although we have matched Navy and civilian occupations, one further step is needed so that comparisons of employment, earnings, educational attainment, etc., can be made. As noted earlier, because of the manner in which skill levels are explicitly treated in defining Navy rating titles, it is necessary to group Navy ratings into families of ratings, and to use this information to allocate individuals at the apprenticeship and "master" levels to the ratings shown in Table 1.

TABLE 5

Number of Census Detailed Occupations (Net) Used
in Matching Navy-Census Occupations

Major Census Occupation Group	No. of Detailed Occupations Used in Group	No. of Detailed Occupations Used in Matching
Professional, technical and kindred workers	124	11
Managers and administrators, except farm	24	0
Sales workers	15	0
Clerical and kindred workers	48	8
Craftsmen and kindred workers	96	32
Operatives, except transport	54	7
Transport equipment operatives	12	1
Laborers, except farm	16	3
Farmers and farm managers	3	0
Farm laborers and foremen	5	0
Service workers, except private household	38	5
Private household workers	6	0
Total	441	67

Although a procedure for doing this is not described here, it is clear that it can be accomplished using the data already developed.

4. Summary

A procedure has been developed for the purpose of identifying Census occupations which correspond to Navy ratings in terms of the nature of tasks performed. The matching of Census to Navy occupations has been subject to the explicit and implicit constraints imposed by the use of two primary sources on which the analysis is based, namely, the Census and the Navy occupational classification systems [1, 8, 9].

The Navy-Census cross-reference list presented here lends itself to endless refinement. It should be remembered that although the cross-reference list matches Navy ratings and Census occupations, this has been accomplished by considering the kinds of tasks involved and the civilian occupations which Navy men trained in these tasks could enter. This is not the same as determining an equivalency between Navy ratings and civilian occupations. Nonetheless, it is felt that as the cross-reference list stands now, it can serve as a useful tool in a number of studies which will enhance our knowledge and understanding of civilian and military labor markets, and can lead to improved policies for maintaining competitive military and civilian work forces.

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